A Comparative Study of Team Based Learning and Individual Learning

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***Abstract*: Learning a course for overall development of a student is the main objective of educational institutions. The procedure followed to teach a course differs from one institution to another. The best way of learning is the focus of study in this paper. This paper hovers light on the learning methods followed, and the analysis of them in order to suggest the better learning method among them. Taking 3rd year Computer Science and Engineering (CSE) undergraduates of two different institutions as participants, the survey was conducted by circulating the questionnaire including 30 questions on important courses of B.E. CSE. The analysis was started with hypothesis that Team Based Learning (TBL) is better way of enhancing individual learning. The results obtained were analysed by applying T-test and chi-square test, the results showed that TBL is the better learning method and the hypothesis was accepted.**

***Keywords*: Interpersonal skill, Team Based Learning, Individual learning, T-test, Chi-square test**

1. INTRODUCTION

Evaluating an interpersonal skill is a difficult task; there may be various reasons to enhance once knowledge. Individual learning and learning in teams are two such approaches where in which an individual can improve skills like problem solving skill, core concept understanding etc. Learning is an individual attempt to become skillful it is unbiased and depends on the interest of a person. There may be situation where a person has the opportunity to learn but is unwilling to do so. It is not possible to forcibly make a person to learn, it is the inner feeling which makes a person to learn but there can be attempts made to inculcate that inner urge to acquire knowledge. In Engineering Educational institutions the attempt is carried out in order to produce a skillful person, to be able to get placed and work for an organization.

In Educational Institutes the way of teaching has been shifted from traditional way, to more modern way, it can be e-learning, project based learning, video based learning etc. The attempts are made mainly to make course more interesting and also help students acquire knowledge by sharing and listening to others. Learning in teams has their own advantages like improving ones communication and listening skills. This paper is a comparative study of knowledge acquired in particular course through working in team and learning individually.

There can be many roles played by the individual while working in team it can be a developer, designer etc. all these roles equally help an individual to be perfect with the overall concept he or she is involved in. Individual learning to some extent hinders the growth of knowledge it can be implementing either a code or its application to real world scenario. The placements are the ultimate goals of most of the engineering institutes and the skill required to clear the interview process is more of practical application of what is learnt rather than what is studied from books by the individual.

Here, we present a comparative study between the concepts learnt through team based activity and learnt individually. The approach involves the identification of difficult concepts and preparing questionnaire to understand the status of students' knowledge in those concepts in engineering institutes. Here, we focus on concepts which are most important as placement point of view. The analysis derived can be used to design the course in an engineering institute and enhance the rate of placements by giving a better understanding of the concepts.

2. BACKGROUND

Learning is an essential part of life. Learning can happen in many ways. Team based learning is one such approach for understanding a difficult and important subject.

The main objective of TBL is to go beyond simply completing content but to focus on ensuring that students have the opportunity to practice using course concepts to solve problems. TBL is designed to provide students with both conceptual and procedural knowledge and, although some time TBL is practiced to ensure that students master the course content. Essential elements of TBL include groups, accountability, and feedback and assignment design (Janotha B., 2015). The students in TBL get frequent feedback for the work they are carrying out which in turn help to redesign the work in certain areas.

TBL not only benefits students but also faculty, administration and college as a whole.

The overall learning of a student is possible only if he or she is actively participating in learning (Bransford J. D., Brown A. L., & Cocking R. R., 2000). In TBL if the assignment reflects real-life contexts and experiences one can understand a course in depth.

Individual learning is ability of a person to learn the course. The essentials of individual learning are learning paths, profile, individual mastery and learning environment. Individual's ability to learn concepts differs from one to another. E-learning, web based learning etc are few attempts to learn a course in depth. Most of the students gain first experience using e-learning. E-learning plays important role in applying technology in students learning (Smart K. & Cappel J., 2006).

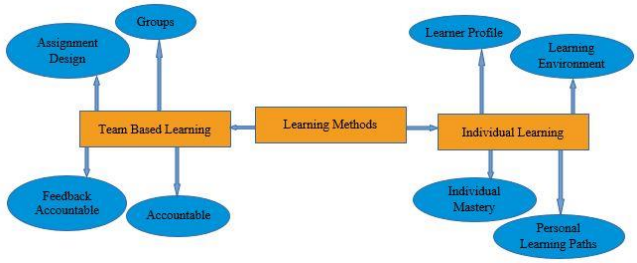

Fig1: Essential elements of TBL and Individual learning

Formation of team in TBL also plays a role for enhancing individual knowledge. Team formed using Kolbe's concept of probing, patterning, innovating and demonstrating also effects team performance as well as increases once knowledge by interacting in team and working together (E. Fitzpatrick, R. Askin and J. Goldberg, 2001). In order to understand a course concept three steps were followed in first step class room teaching of a course was conducted, second step concentrated on laboratory experiments and third step on giving a course project to implement the course learnt, this was on a particular course on 8051 microcontroller. The results showed that the end products of project were satisfactory and the students not only gained mastery over the course but also improved presentation and communication skills(Nayak A. S., Vishwanath G. G., & Umadevi F. M. , 2015).

As formation of team is one main criterion for development of student's individual skill likewise increasing one's own knowledge without the help of team members is also equally important. After forming team on certain criteria and before students started to work on project they were asked to go through the concept they are working on in the project and a prerequisite test was taken to mark individual ability in a team. Peer rating were taken during the course of completion of project to track individual performance and the results showed that teams formed on good team design showed better team as well as individual performance (Battur S., Patil M. S., Desai P., Vijayalakshmi M., Raikar M. M., Hegde P., & Joshi G. H., 2016).

Competence is one such behavior which helps one learn in team. The conceptual analysis in terms of individual goal orientation and creativity was contingent on team learning behaviour (Hirst G., Van Knippenberg D., & Zhou J., 2009). Extent or means through which the process might lead to reappointment of skills among the individuals taking intent, receptivity and transparency was carried out. This resulted in telling that competitive learning and intent, receptivity and transparency are determinant of learning (Hamel, G., 1991).

Now a days, the task of teachers is altered from transferring knowledge into facilitating the learning process of students. The learning principles followed include, (1)Cognitive approach which includes problem solving by doing projects.(2)Contents approach means understanding the subject.(3)Social approach that is team based learning. Engineering institutes aim at producing skilled students. TBL and problem based solving add to skills by providing and promoting linkages and understanding the concepts in depth (Lehmann M., Christensen P., Du X., & Thrane M., 2008). Cooperative learning using TBL can be used to teach specific content, ensure active cognitive processing during a lecture, to provide long-term support and provide overall structure to team work in engineering classes (Smith K. A., 1995).

3. METHODOLOGY

This study is mainly required in order to choose a better way to learn different important concepts in a course. The population under study considered here are the two engineering colleges one is private University i.e., population A and another is a VTU affiliated college i.e., population B as shown in Fig 2. The teaching methods followed in both the colleges are different as VTU affiliated college follows teacher-centric approach and the students learn the course by what is thought by the teaching faculty in the college whereas in the private University learner-centric approach is followed and the students learn a course in team by interacting and applying what is thought by the faculty. The data used for analysis in this paper are collected from the 3rd year graduates of B.E computer science department from both the colleges. The approach followed is initially the difficult courses were identified. These courses were chosen keeping in mind whether the course is just a theoretical one or the application of the theory studied is required to solve the problems. These courses were also chosen by forsaking their importance in the placements of the students in their 4th year. In order to test the effectiveness of the concepts in a course learnt the survey is conducted. The important courses selected were Data Structures, Computer Organization, Design, and Analysis of Algorithms. These courses have their own impact in solving customer problems and help the companies in gaining their business. After identifying the courses, the database consisting questionnaire of these three courses was prepared. Later 30 questions 10 belonging to each of the courses identified where selected from database and a Google form were prepared (http://bit.ly/2yDWFjZ). The questionnaire chosen mainly concentrated on the concepts like memory management, complexity study of algorithms and their application etc belonging to different bloom's level (L1, L2) which are considered important as

career point of view. After data collection phase the statistical measure to be applied in order to analyze the responses was chosen as t-test and chi-square test.

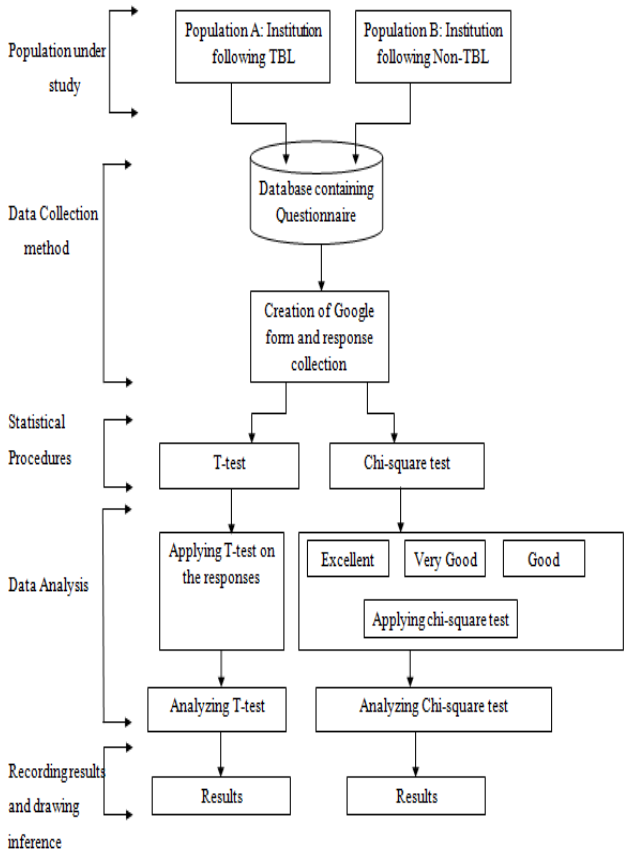

Fig 2: Proposed methodology

The questionnaire was distributed among the students of both the colleges. Around 51 responses were received. The responses received where subjected to analysis. The results obtained where recorded and inferences were drawn.

4. RESULT ANALYSIS

The responses of the questionnaire taken were then analysed by applying t-test to the scores obtained. The t-test was chosen as the analysis is to be done on two populations of small sample size. The null hypothesis was assumed to be "TBL is better form of Learning Method". The result showed that mean for the TBL is 14.73 and Non-TBL is 14.42 as shown in Table1. The level of significance was assumed to be 0.05. The result from the test showed the observed P value for two tailed test is 0.426 , from chi-square distribution table we find that for P value of 0.05 the value in table is >0.426 . Hence, we accept the null hypothesis that TBL is better learning method

Later the chi-square test was applied in order to compare the observed results with the expected results. The same 51 responses were subjected to chi-square test by dividing into three Likert scale as Excellent, very good and good based on the scores between 20-30, 11-20 and 1-10 respectively as shown in Table2. The null hypothesis was assumed to be Ho: "Individual performance depends on learning methods". After the application of the chi-square test with degrees of freedom = (C-1)(R-1) = 2 , the chi-square value was found to be (Table 3) 0.368. Entering the Chi square distribution table with 2 degree of freedom and reading along the row we find our value of x^2 (0.368) is <1.386. The corresponding probability is 0.5. This means that the p-value is above 0.05 . Since a p-value of 0.368 is greater than the conventionally accepted significance level of 0.05 (i.e. p > 0.05) we accept the null hypothesis.

Table1: The T-test results

t-Test: Two-Sample Assuming Equal Variances		
	Non-TBL	*TBL*
Mean	14.428571	14.733333
Observations	21	30
Pooled Variance	32.836929	
Hypothesized Mean Difference	0	
Df	49	
t Stat	-0.1869238	
P(T<=t) one-tail	0.4262461	
t Critical one-tail	1.6765509	
P(T<=t) two-tail	0.8524922	
t Critical two-tail	2.0095752	

Table 2: Distribution of Scores using Likert 3-point scale

		3 Point Likert Scale			
		Excellent	**Very Good**	**Good**	**Total**
Learning Methods	TBL	6	14	10	30
	Non-TBL	5	8	8	21
	Total	11	22	18	51

Table3: The calculation of O_i,E_i and chi-square for the given scores

Observed(O_i)	Theoritical(E_i)	$(O_i-E_i)^2/E_i$
6	6.47	0.034
14	12.94	0.087
10	10.59	0.033
5	4.53	0.048
8	9.06	0.12
8	7.41	0.046
		Sum=0.368

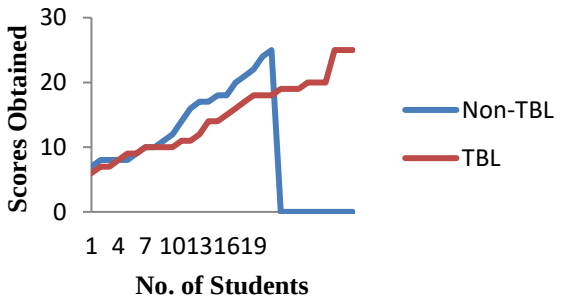

Fig 3: Graph showing the scores of two institutions.

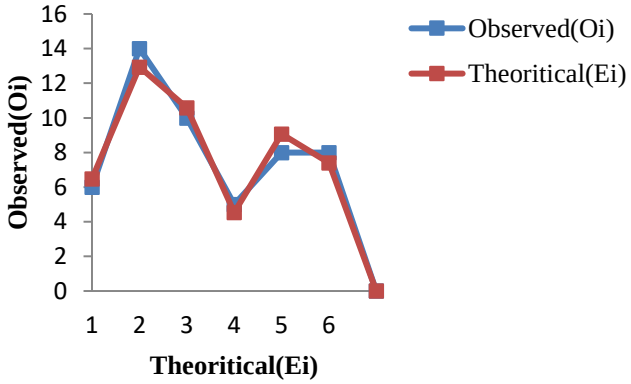

Fig4: Graph showing Observed and Theoretical scores based on the Likert scale as mentioned in Table2.

From Fig3. We can observe that the scores of two institutions on y-axis and number of participants on x-axis. The graph shows that the score where team based learning is followed shows more concentration of marks at higher end whereas it's not the case in another institute it shows scores are scattered and less people scoring higher marks.

From Fig 4. We see that the observed and theoretical values have less difference and hence chi-square value obtained is less. So, the null hypothesis is accepted because the P obtained is less than 0.05.

5. Discussion

The study provides initial survey on the learning methods followed in Engineering colleges. The responses obtained where not total satisfactory. The results obtained are as the part of survey conducted between two institutions, which followed team based, and non-team based learning. The results are based on small data of 51 students hence the conclusion of accepting that TBL is better approach of learning is not universal. The factors like interpersonal skill of a student, the college environment, the class they are learning in, the type of team formed etc also influence the learning method.

The analysis was conducted on two institutions in which one college was VTU affiliated and another was private university. Hence, the scheme, syllabus, question pattern, duration etc also differ in both the institutions which might also be the reason for observing the above discussed results. The result that TBL is better method of learning may also become contradiction if the survey is conducted between two VTU affiliated colleges or between two private universities.

The survey was conducted on 3rd year B.E computer science undergraduates. If the same survey is conducted for students of different semesters, the result obtained may not remain the same. As the analyzing capacity of a student on the subject differs among the students of different years. As the participants of survey change there may arise many factors that influence the study and the better method of learning differs.

The performance of students was found good in certain questions of the questionnaire, which had subjective, questions and where part of study between both the institutions. The results or scores differed in questions, which had application and little out of box thinking.

The participants of the survey are 3rd year undergraduates and the questionnaire circulated were based on the courses they had learnt in their 2nd year i.e., in 3rd and 4th semester. The affiliated college had Computer Organization subject in 3rd semester and Design and Analysis of Algorithm as well as Data Structure subject in 4th semester. In private university Data structure was thought in 3rd semester and Computer Organization, Design and Analysis of Algorithm were thought in 4th semester. Since the subjects where thought in different semesters in both the colleges, this might also be the reason for obtaining the result as above. As the other might have affected the performance programming as well as theoretical subjects learnt in their respective colleges.

The factors like semester end results i.e., either CGPA or percentage could also be related to the learning methods. It was an interesting outcome that showed the semester end results of students who followed team based learning was much higher than those who did not follow team based learning. Since, the two institutions did not belong to the same affiliated university the result was not considered as the part of study.

Finally, we should note that the results obtained are as part of the questionnaire formed based on the difficult courses identified. The result that "Team based learning is better method of learning" is limited to the scope defined and may differ if other factors are considered.

6. Conclusion

The survey shows that the learner-centric approach is better and hence proves that team based learning enhances individual performance. The results proved hold good in the conditions considered above. The results also show that the results leaning method followed. TBL is better approach in order to understand the concepts in a course which require application in real world by performing course projects etc. Non-TBL is better to the students whose individual learning paths are innovative and have many learning environment.

The future scope of the study can be analyzing the effect of team formation strategy on the individual development. There can be many reasons for which the TBL may not be effective in certain situation. Hence, it is also important that for overall development of individual the team formed is cooperative and has the required skills.

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